City of Santa Barbara

Sea Level Rise Adaptation Plan for the Local Coastal Program Update – Subcommittee Meeting 4

Photo Courtesy of Michael Theis

Disclaimer:

This presentation and the information presented herein is considered work-in-progress and shall not be relied upon as final.

ESA Team Presentation Outline

- Vulnerability Assessment Draft
- Economics Methodology Draft
- Next Step - Adaptation Planning
- Discussion

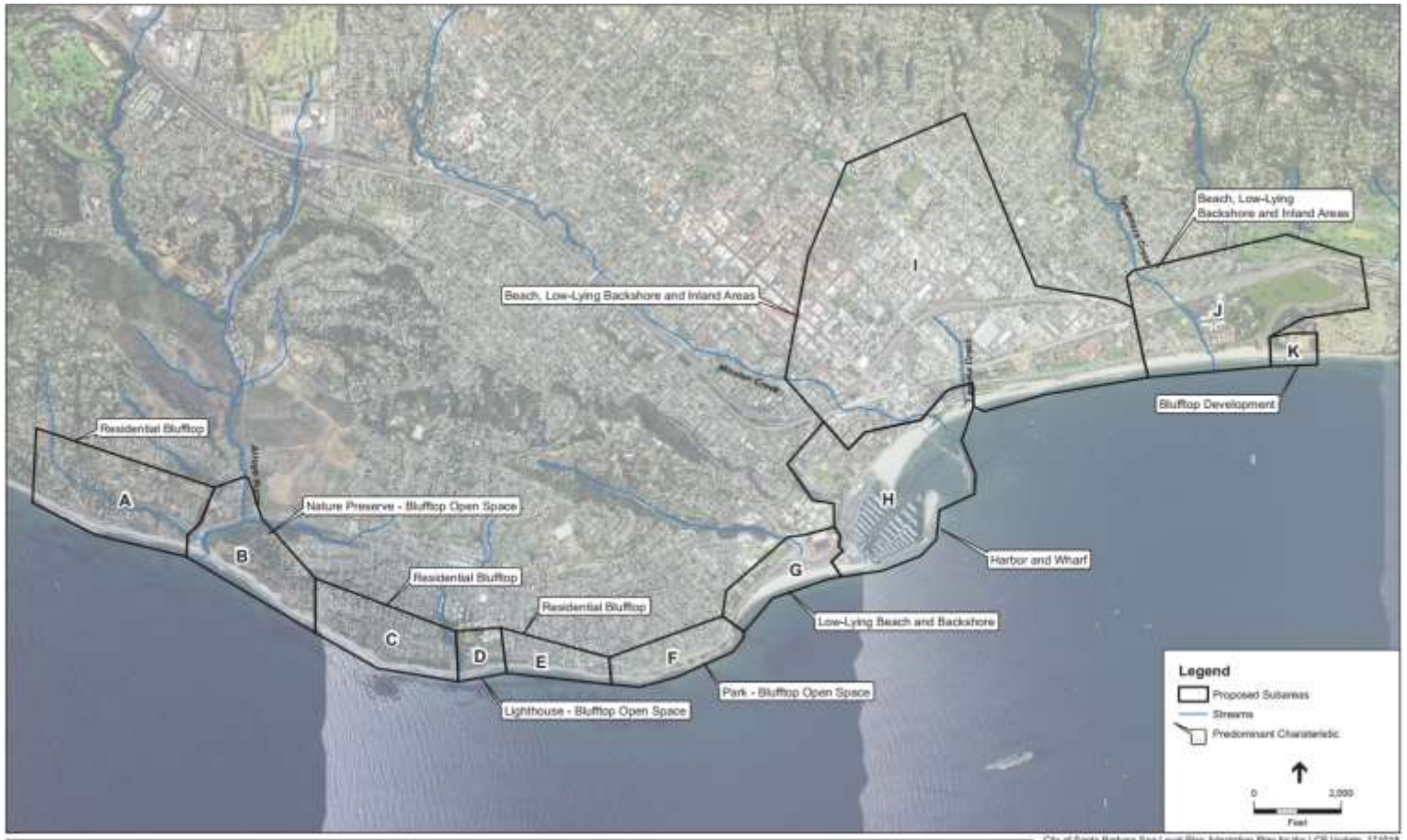
Vulnerability Presentation Outline

- Overview
- Study Subareas
- Sea-level Rise Scenarios
- Coastal Hazard Types and Class
- Summary Hazard Maps
- Asset Categories and Key Findings
- Next Steps

Vulnerability Assessment Overview

- "No adaptation scenario" - no action
  - First step toward adaptation and policy planning
  - High level look at impacts
  - Provides basis for planning potential adaptation strategies in next step
- Components
  - Identify assets in hazard zone
  - Assign economic value of assets
  - Review vulnerability (overall, asset category, subarea)

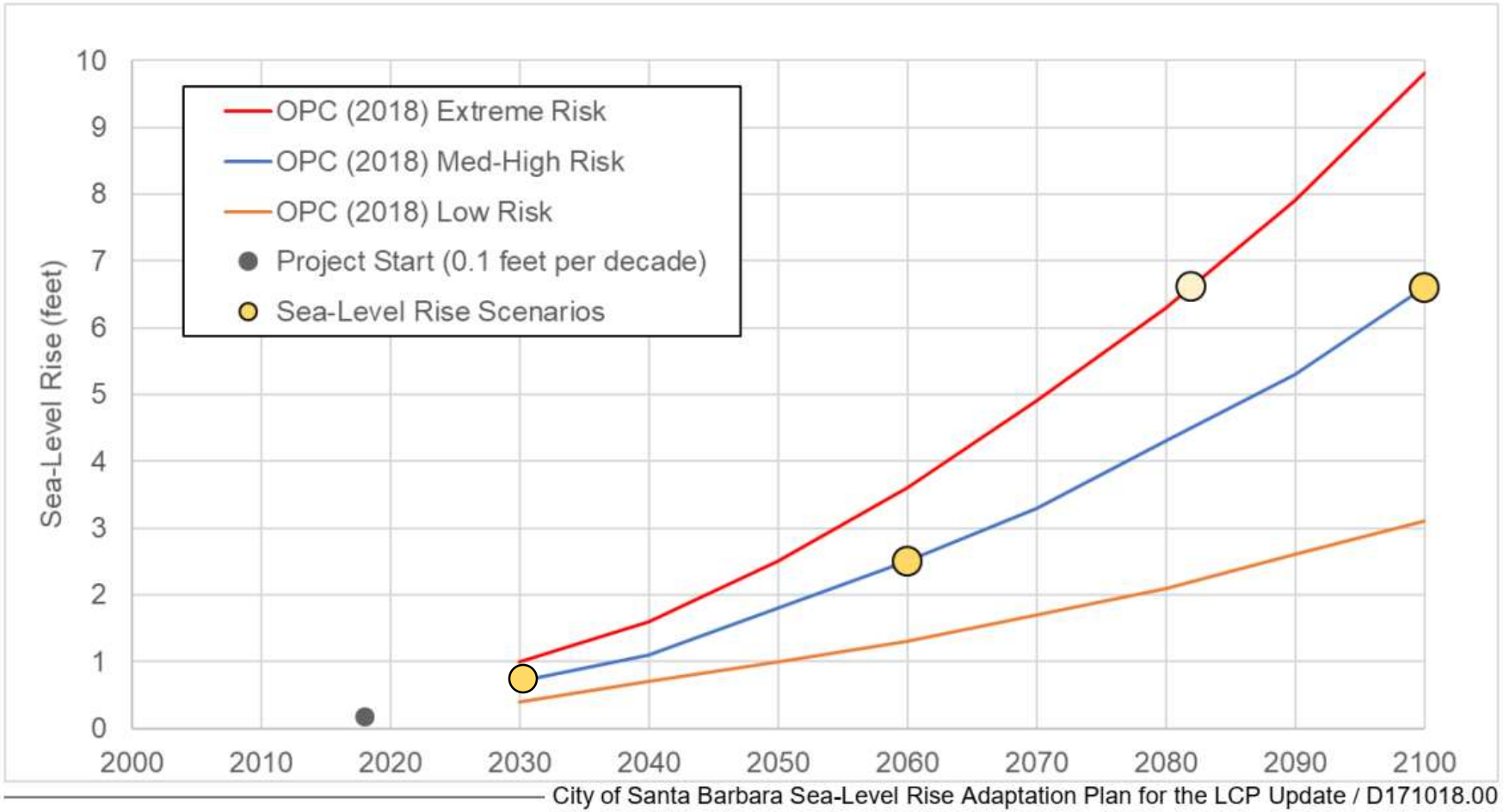
Study "Subareas"



SOURCE: City of Santa Barbara Sea-Level Rise Adaptation Plan for the LCP Update, 1/10/18

Figure 1
Shoreline Hazard Planning Subareas

Sea-level Rise Scenarios



SOURCE: OPC 2018

Figure 5
Updated OPC (2018) Sea-Level Rise Guidance Curves, with Selected Scenarios

Hazard Types and Impact Class

Hazard Type	Impact Class
Erosion (bluff or shoreline)	Permanent, complete loss
Tidal Inundation	Permanent, complete loss
Storm Waves	Temporary, damages
Storm Flooding	Temporary, damages
Flood-prone / Low-lying	Temporary, damages

Coastal Hazard Types - Permanent

Bluff Erosion

Source: California Coastal Commission

Tidal Inundation

Source: Jenna Driscoll, SB Channelkeeper King Tides Initiative

Shoreline Erosion

Coastal Hazard Types - Temporary

Storm Waves

Flood Prone/Low-Lying

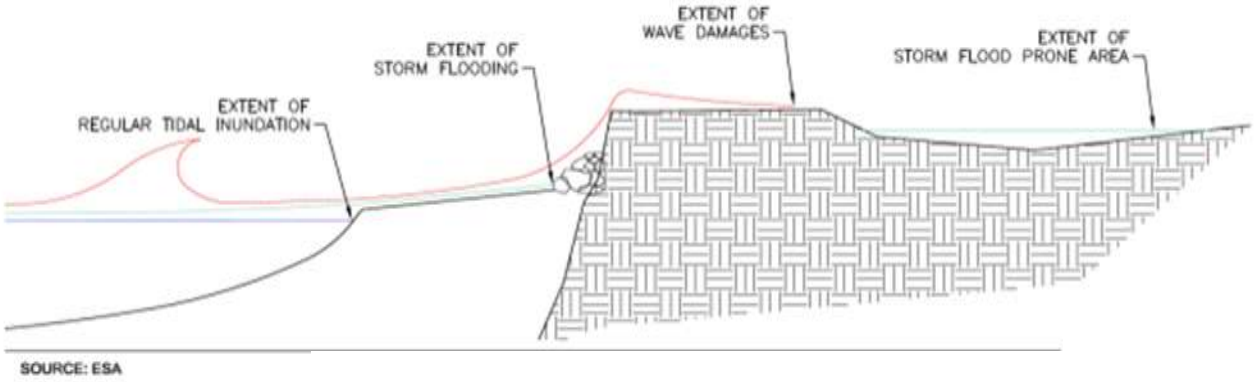
Storm Flooding

Storm Flooding / Wave Runup

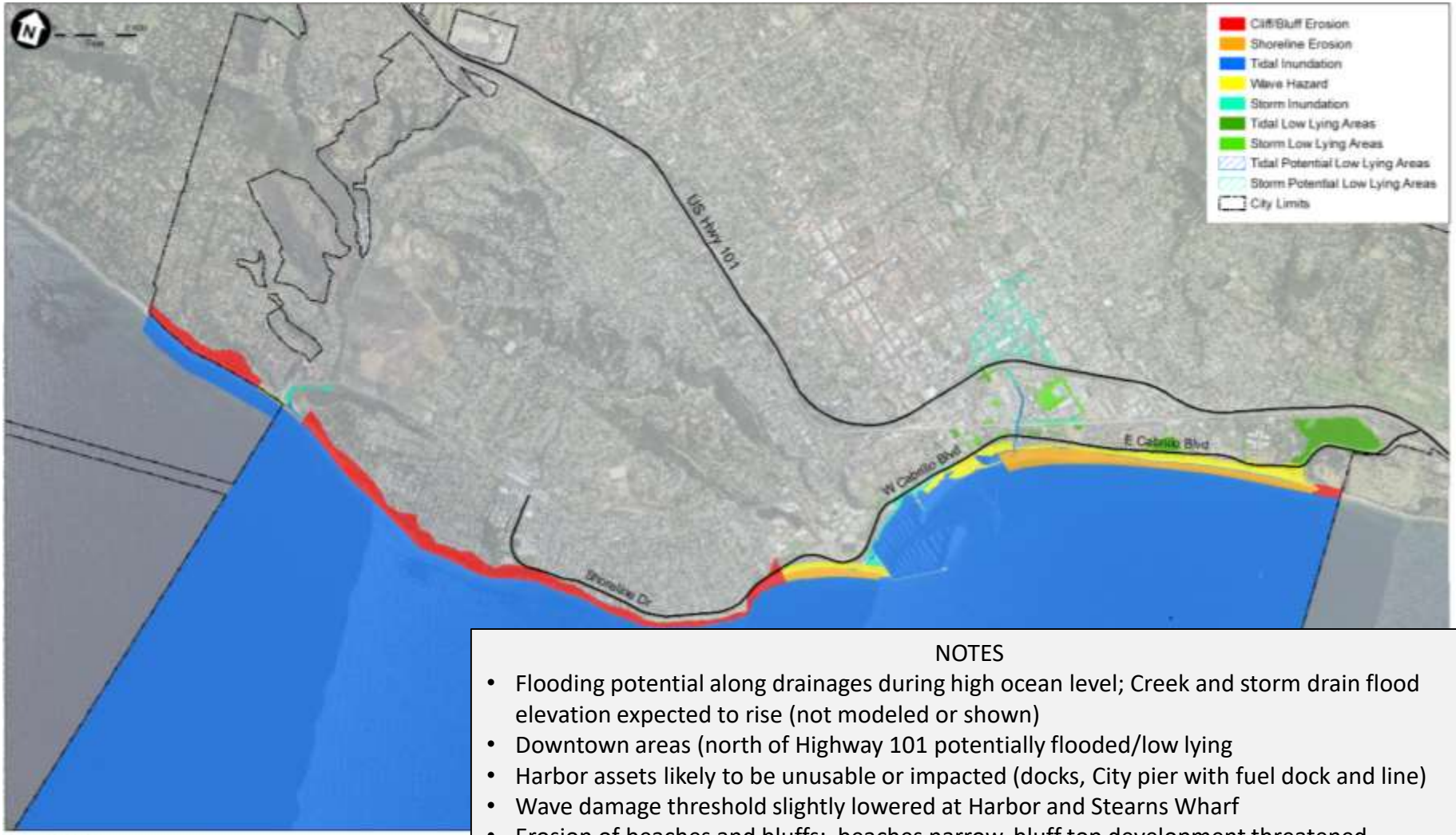
Schematic of Hazard Types and Classes

Permanent = Erosion and Flooding due to elevated ocean levels
Can include low lying inland areas due to rising groundwater

Temporary = High wave runup and extreme high ocean levels
Can include low lying inland areas



Future Hazards at year 2060

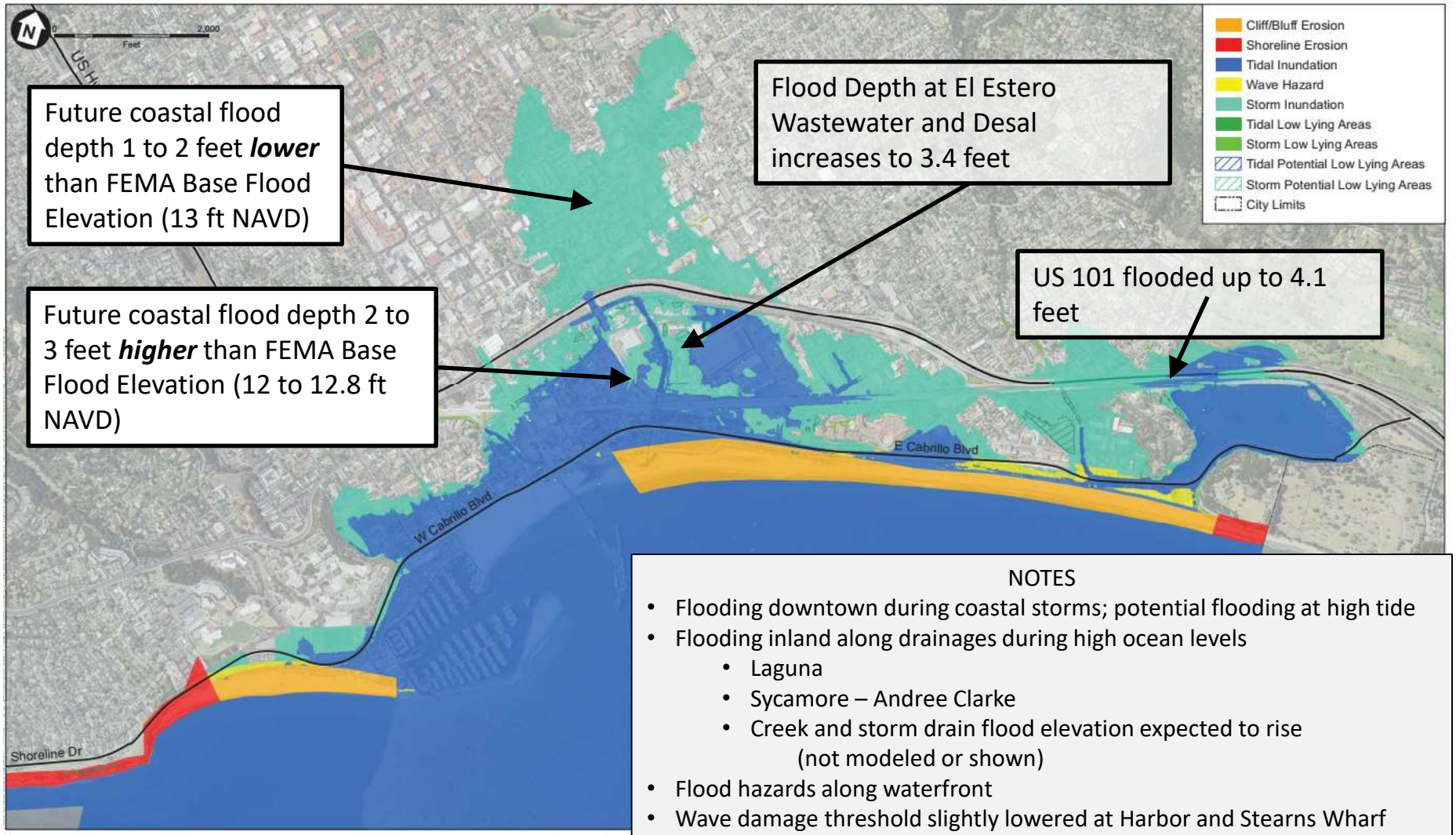


SOURCE: USGS, ESA

NOTES

- Flooding potential along drainages during high ocean level; Creek and storm drain flood elevation expected to rise (not modeled or shown)
- Downtown areas (north of Highway 101 potentially flooded/low lying
- Harbor assets likely to be unusable or impacted (docks, City pier with fuel dock and line)
- Wave damage threshold slightly lowered at Harbor and Stearns Wharf
- Erosion of beaches and bluffs: beaches narrow, bluff top development threatened
- Wave hazards reach E. Cabrillo Blvd
- Some coastal access and parks damaged or lost
- Wetlands areas not lost but impacted (not modeled or shown)

Future Hazards at year 2100 – East Side

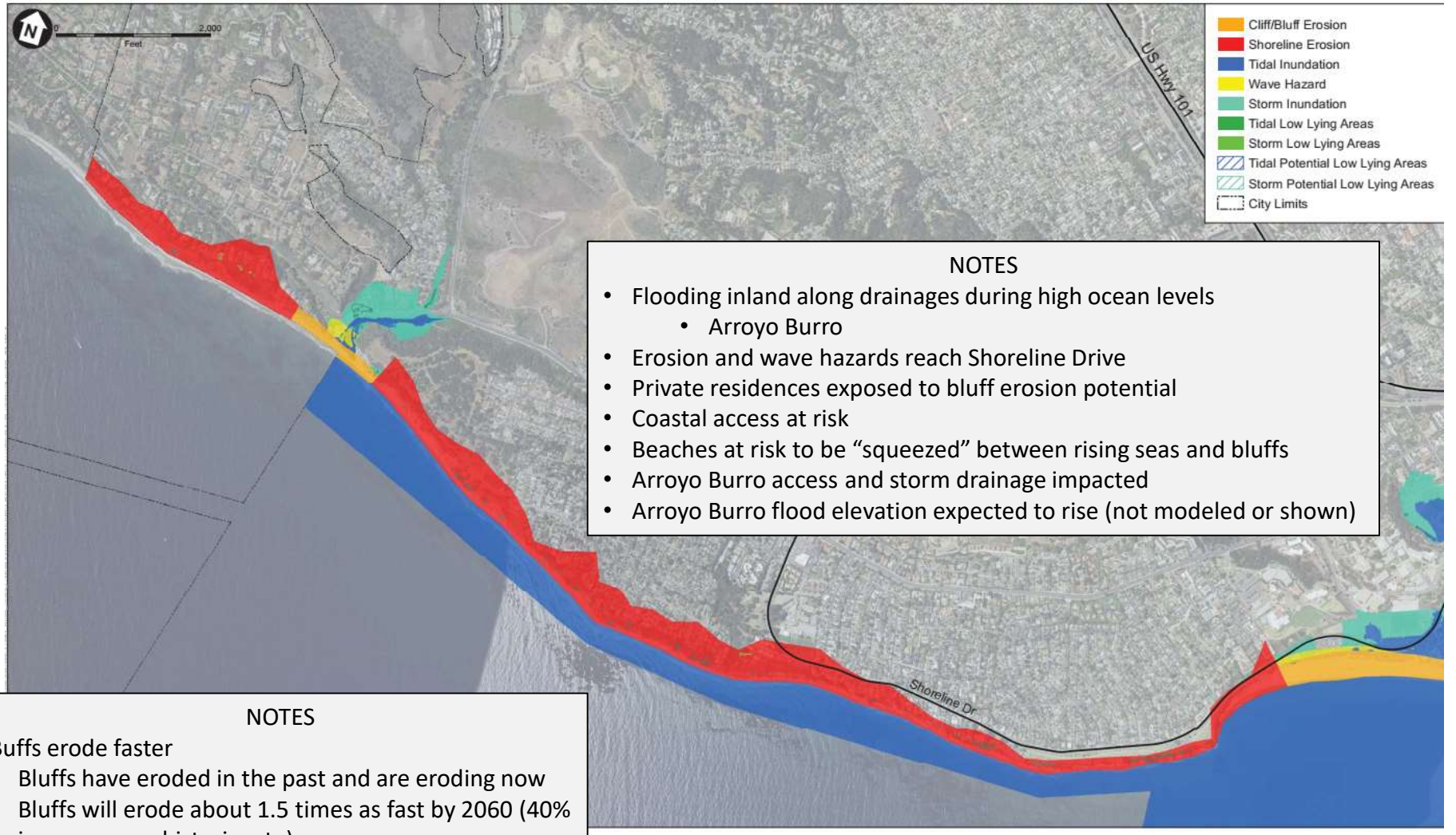


SOURCE: USGS, ESA

NOTES

- Flooding downtown during coastal storms; potential flooding at high tide
- Flooding inland along drainages during high ocean levels
  - Laguna
  - Sycamore – Andree Clarke
  - Creek and storm drain flood elevation expected to rise (not modeled or shown)
- Flood hazards along waterfront
- Wave damage threshold slightly lowered at Harbor and Stearns Wharf
- Erosion and wave hazards reach E. Cabrillo Blvd and Shoreline Drive
- Coastal access and parks damaged or lost
- Wetlands areas not lost but impacted (not modeled or shown)

Future Hazards year 2100 – West Side



NOTES

- Flooding inland along drainages during high ocean levels
  - Arroyo Burro
- Erosion and wave hazards reach Shoreline Drive
- Private residences exposed to bluff erosion potential
- Coastal access at risk
- Beaches at risk to be “squeezed” between rising seas and bluffs
- Arroyo Burro access and storm drainage impacted
- Arroyo Burro flood elevation expected to rise (not modeled or shown)

NOTES

Buffs erode faster

- Bluffs have eroded in the past and are eroding now
- Bluffs will erode about 1.5 times as fast by 2060 (40% increase over historic rate)
- Bluffs will erode more than twice as fast by 2100 (140% increase over historic rate)

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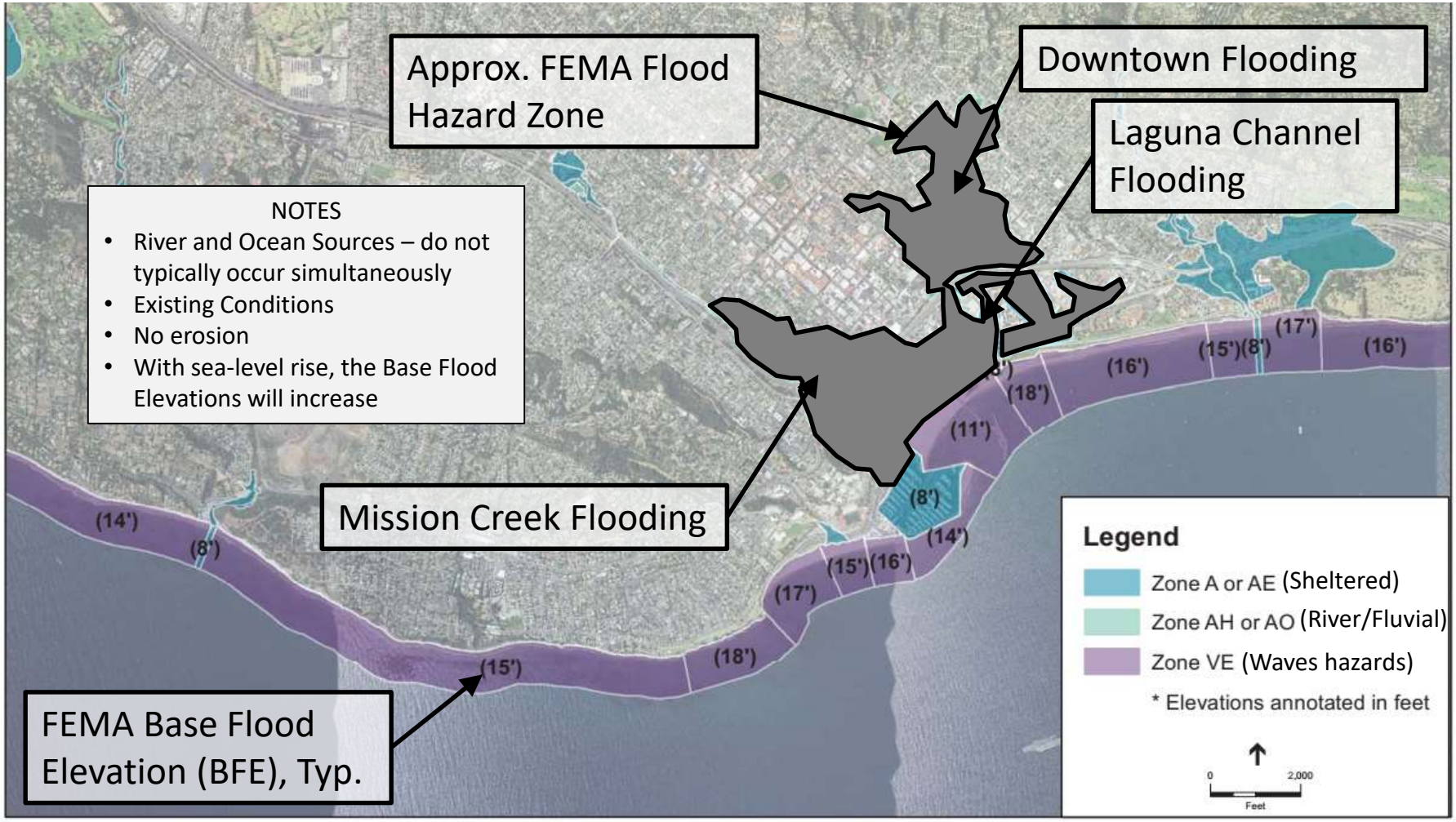
Figure 11
2100 Hazards (West)

FEMA Flood Insurance Rate Map: Coastal & River Flooding 100-year Base Flood Elevation



SOURCE: FEMA 2018

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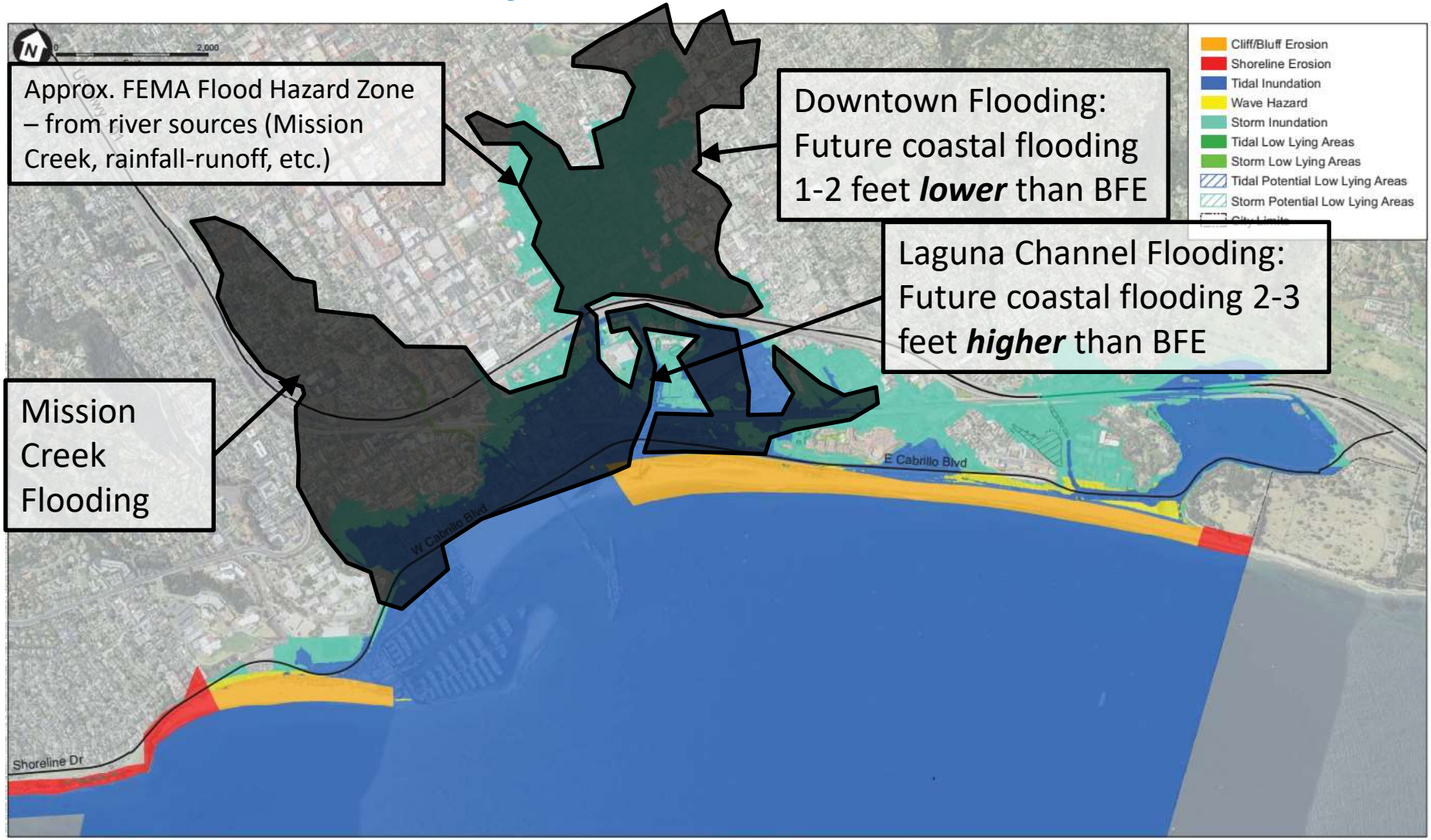
Figure 2

FEMA Special Flood Hazad Zones in Santa Barbara

Future Hazards at year 2100 – East Side



SOURCE: USGS, ESA

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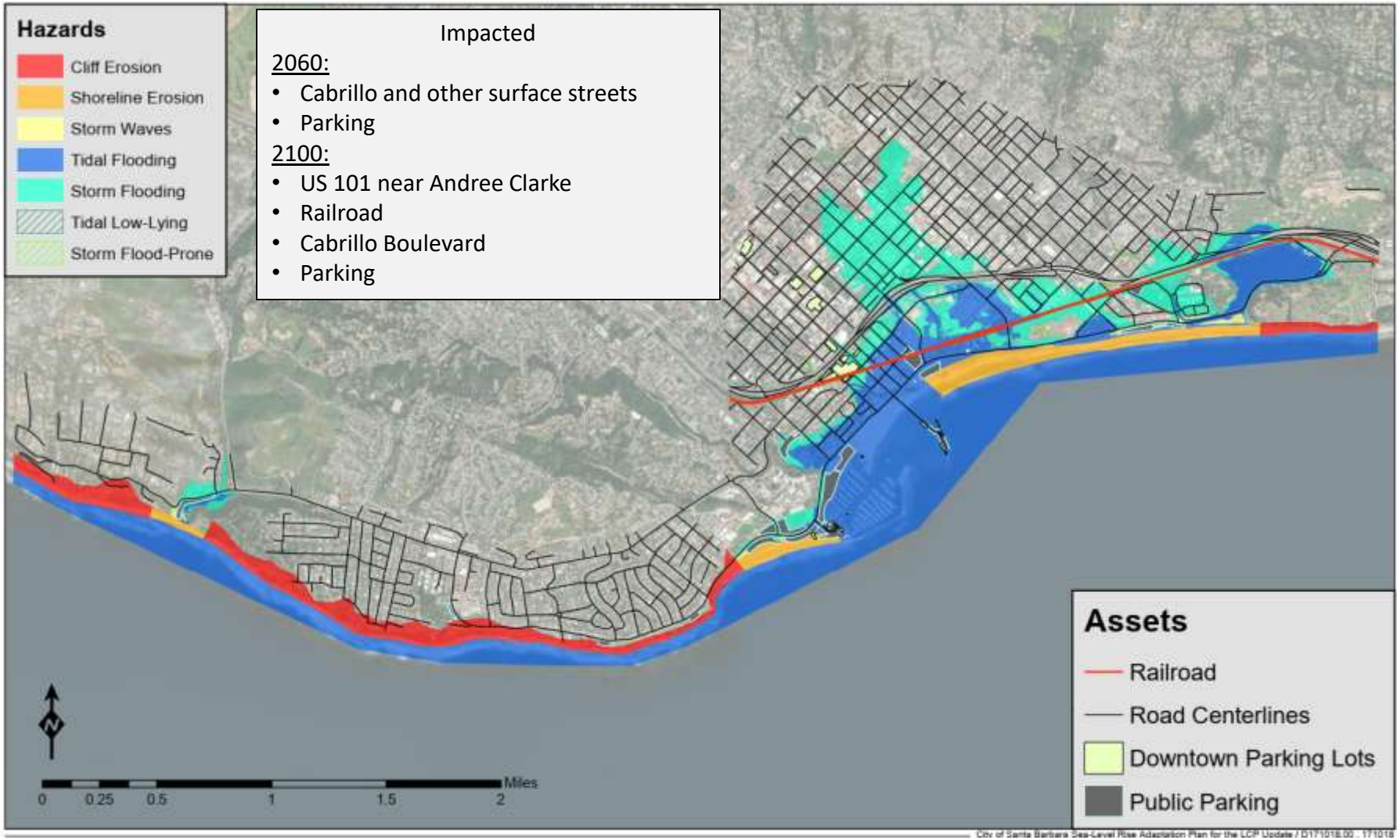
Figure 10
2100 Hazards (East)

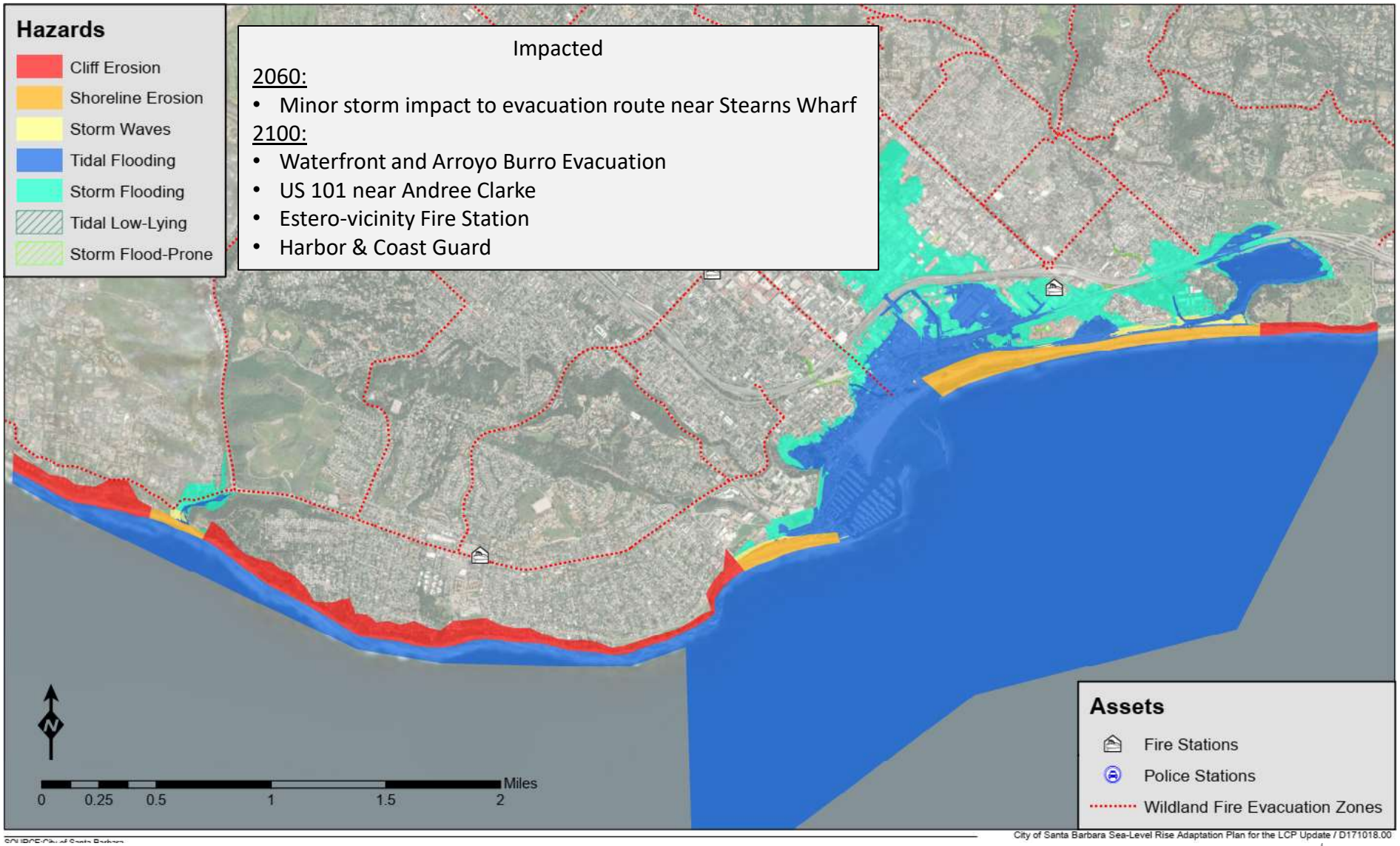
Asset Categories

- **Transportation**
- **Emergency Facilities**
- **Stormwater Infrastructure**
- **Recreational**
- **Harbor**
- **Public and Private Property (Parcels)**
- Communications
- Water Supply
- Wastewater

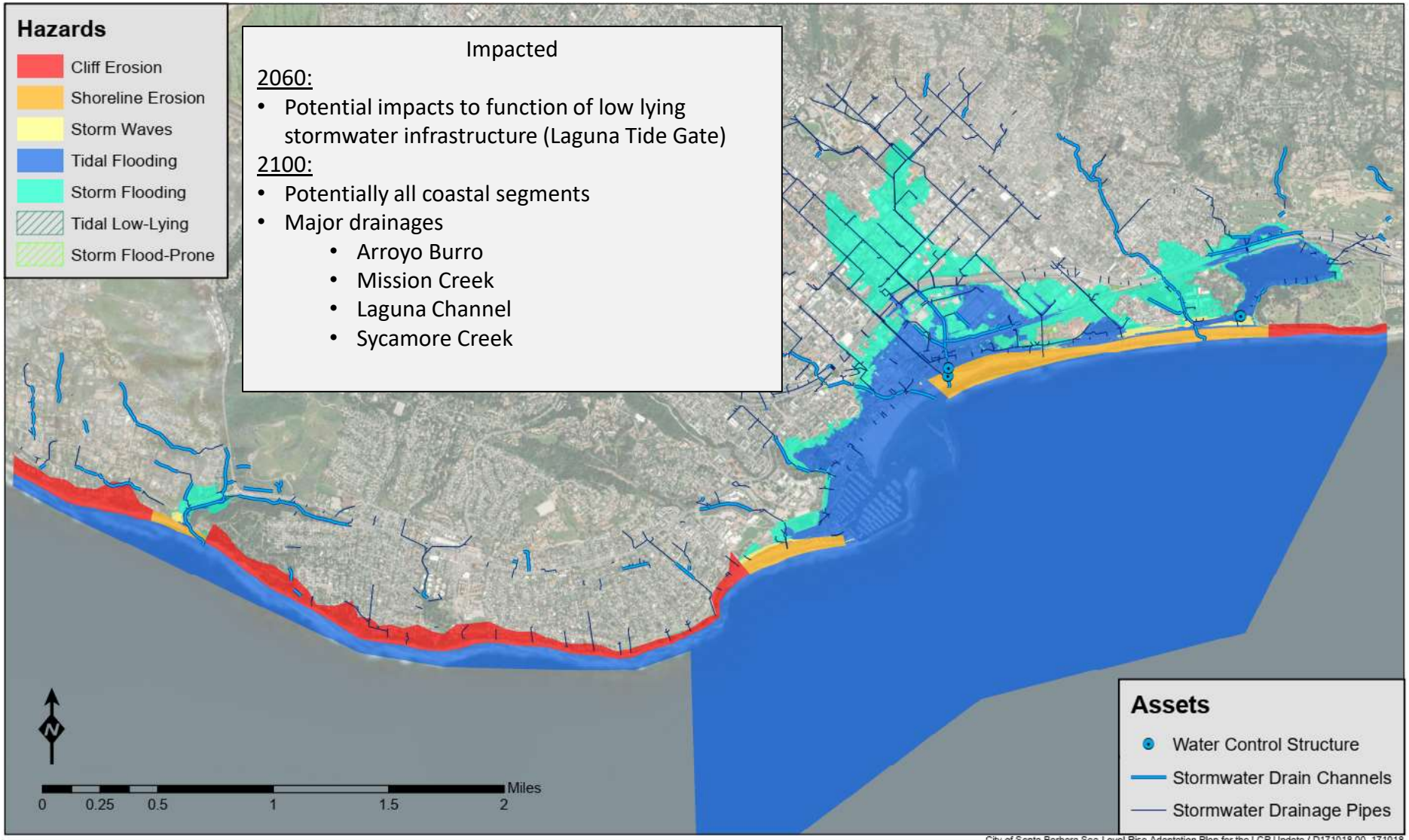
Key Vulnerabilities: Transportation



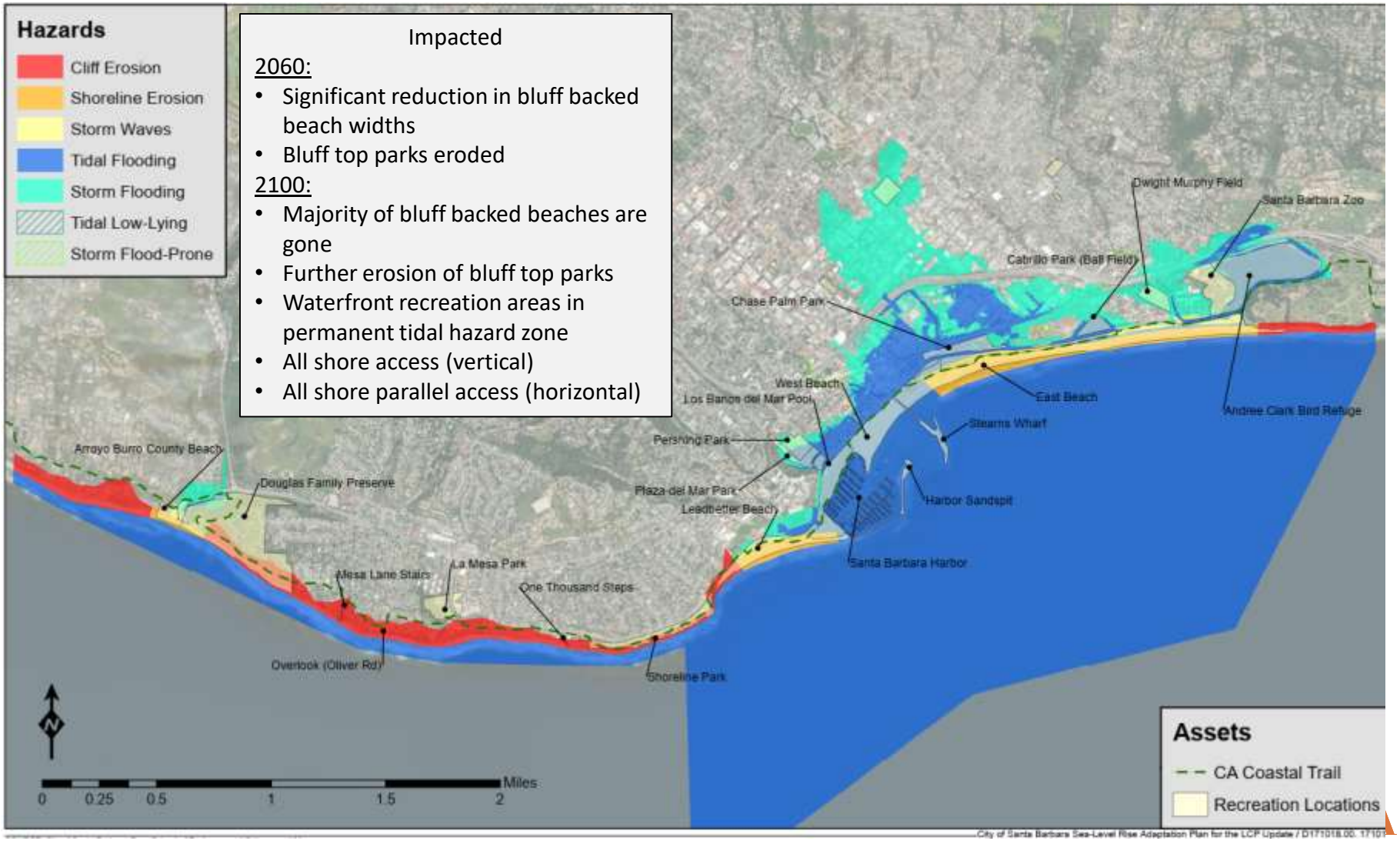
Key Vulnerabilities: Emergency Facilities



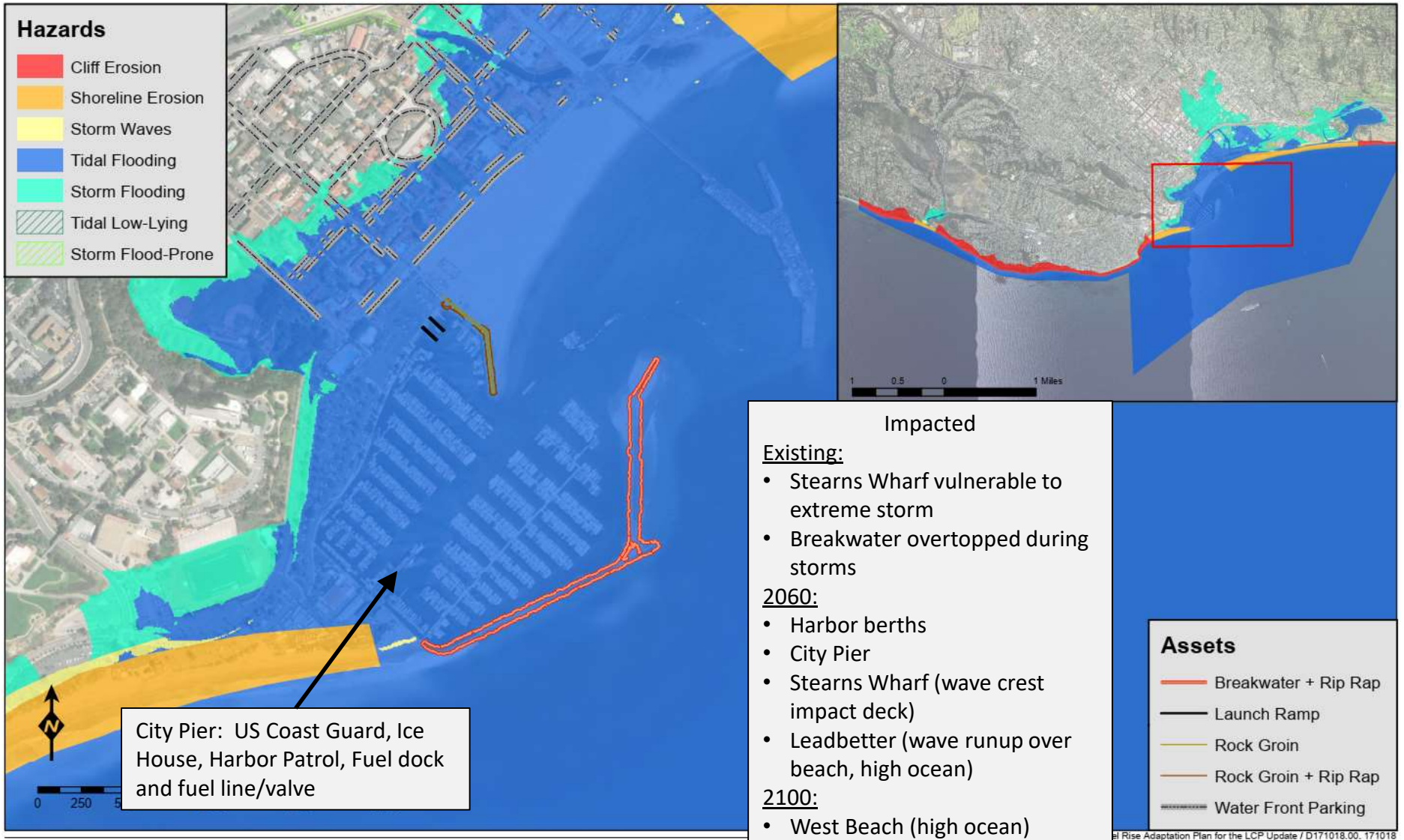
Key Vulnerabilities: Stormwater Infrastructure



Key Vulnerabilities: Recreational



Key Vulnerabilities: Harbor



Impacted

Existing:

- Stearns Wharf vulnerable to extreme storm
- Breakwater overtopped during storms

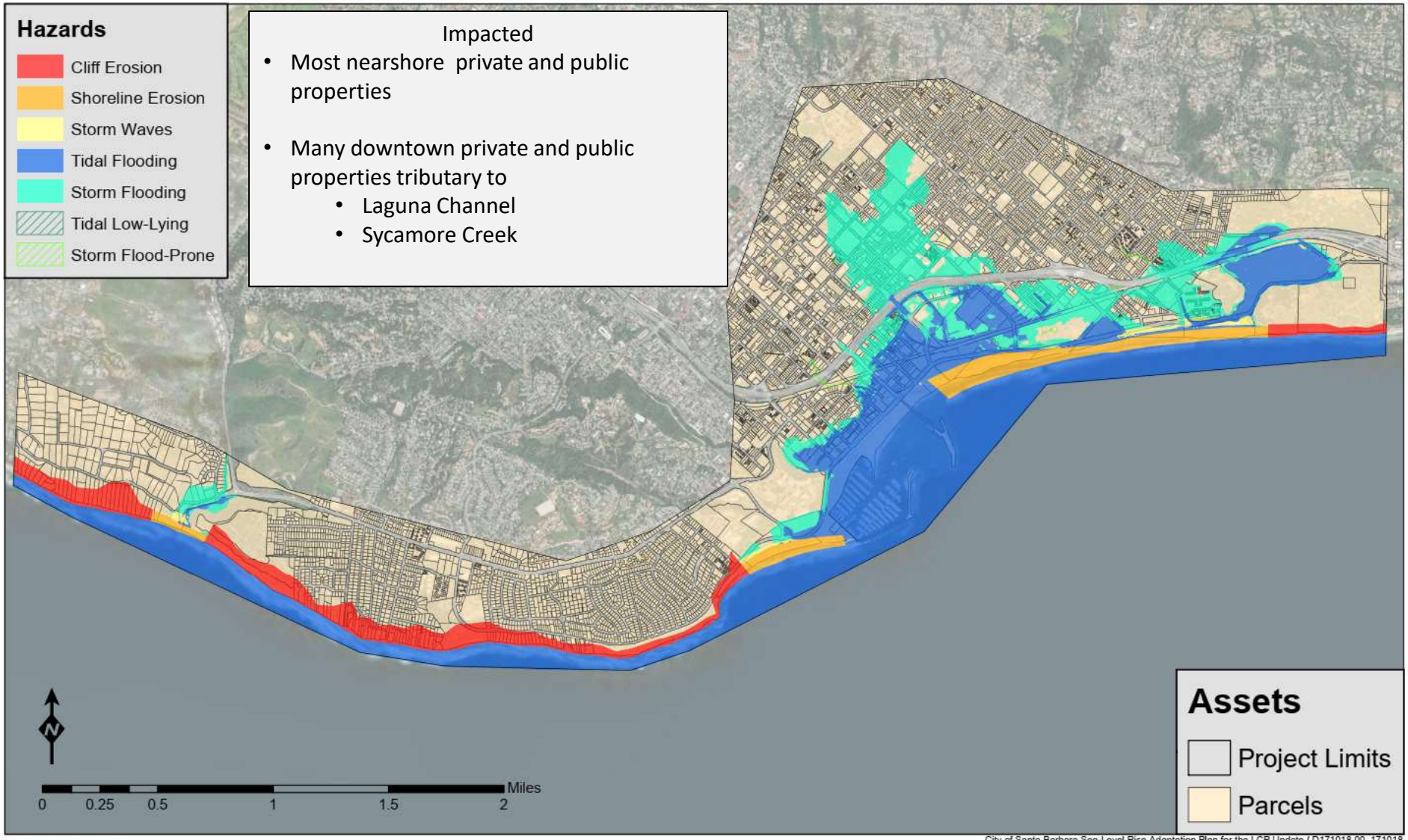
2060:

- Harbor berths
- City Pier
- Stearns Wharf (wave crest impact deck)
- Leadbetter (wave runup over beach, high ocean)

2100:

- West Beach (high ocean)
- Harbor businesses and offices
- Parking and access

Key Vulnerabilities: Parcels – private and public



SOURCE:City of Santa Barbara

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Figure 17
Asset Hazard Map: Public and Private Properties
Hazards with 6.6 ft SLR

Key Vulnerabilities: Parcels – Private and Public

Parcel Count by Type Intersecting with Hazard Zones

Vulnerable Parcels (Count)						
	Existing Conditions		2060 Conditions		2100 Conditions	
	Storm	Tidal	Storm	Tidal + Erosion	Storm	Tidal + Erosion
Commercial	0	2	2	3	124	46
Government	0	1	0	0	9	0
Hotels, Motels, B&Bs	0	0	4	0	13	26
Industrial	3	0	4	3	151	61
Institutional	2	0	0	8	11	10
Miscellaneous	2	0	3	2	5	18
Recreational(a)	0	0	0	0	4	4
Residential	22	48	0	115	485	221
Vacant	4	5	0	16	16	24
TOTAL	33	56	13	147	818	410

NOTES:

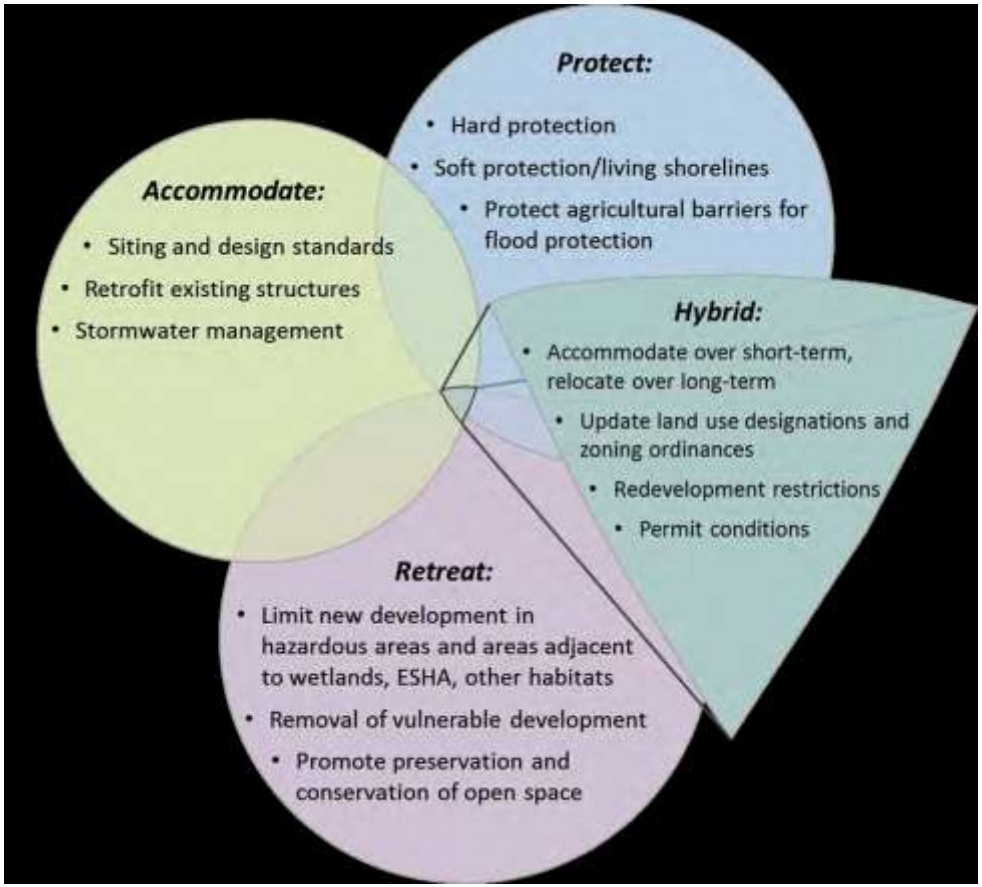
a "Recreational" assets include: golf courses, auditoriums, stadiums, and other recreational land uses. Parks are included separately in Table 14 "Vulnerable Recreational Assets" table. For Parking, see Table 13 "Vulnerable Parking

Summary of Remaining Vulnerabilities

- Communications Infrastructure
  - 2060 – temporary inundation, particularly along waterfront
  - 2100 – tidal inundation, access and maintenance challenges
- Water Supply and Wastewater Infrastructure
  - 2060:
    - Recycled Water System and mains
    - Sewer: Gravity mains, laterals
  - 2100:
    - El Estero Wastewater Treatment Plant
    - Desalination Plant
    - Ortega Groundwater Treatment Plant

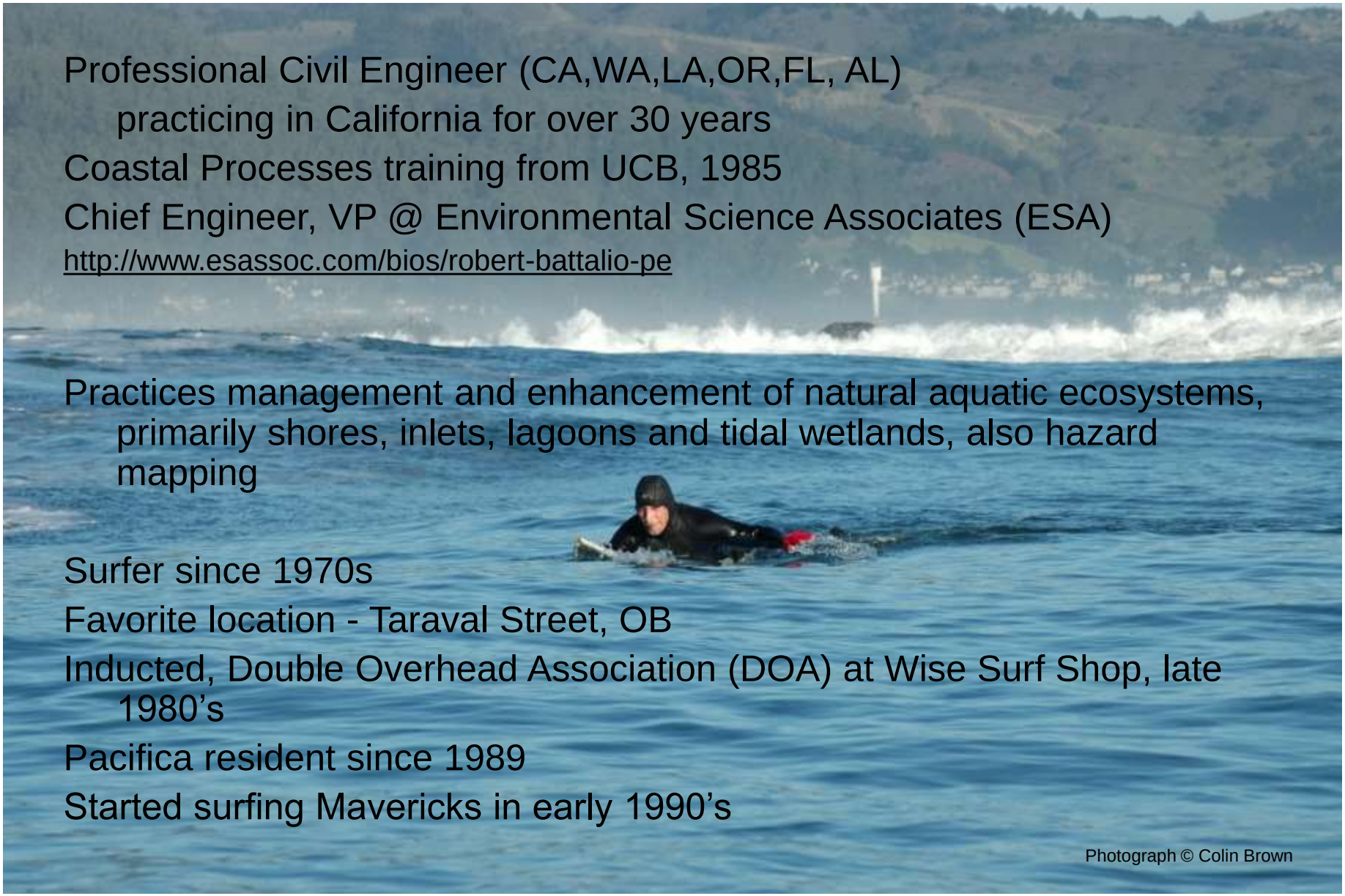
Next Steps

- Adaptation Plan
  - Scenarios
  - Modeling
  - Economics
  - Evaluation
- Policy development and Local Coastal Plan Amendment



Source: Coastal Commission Guidelines

Who is this dude ?



Professional Civil Engineer (CA,WA,LA,OR,FL, AL)
practicing in California for over 30 years

Coastal Processes training from UCB, 1985

Chief Engineer, VP @ Environmental Science Associates (ESA)

http://www.esassoc.com/bios/robert-battalio-pe

Practices management and enhancement of natural aquatic ecosystems, primarily shores, inlets, lagoons and tidal wetlands, also hazard mapping

Surfer since 1970s

Favorite location - Taraval Street, OB

Inducted, Double Overhead Association (DOA) at Wise Surf Shop, late 1980's

Pacifica resident since 1989

Started surfing Mavericks in early 1990's

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Ocean Beach, San Francisco, vicinity of Taraval Street 1980s, Photograph by Tim Britton